DOCKET NO: 296729US0PCT

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
CHRISTIAN WALSDORFF, ET AL.	: EXAMINER: NGUYEN, NGOC YEN M.
SERIAL NO: 10/594,243	:
FILED: SEPTEMBER 25, 2006 RCE FILED: AUGUST 4, 2010	: GROUP ART UNIT: 1734
FOR: FLUIDIZED BED METHOD AND REACTOR FOR CARRYING OUT EXOTHERMIC CHEMICAL EQUILIBRIUM REACTION	:

APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

This is an appeal of the Final Rejection dated September 29, 2011 of Claims 10, 13-17 and 19-26. A Notice of Appeal was filed on December 29, 2011.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is BASF SE, having an address at 67056 Ludwigshafen, Germany.

II. RELATED APPEALS AND INTERFERENCES

Appellant, Appellant's legal representative and the assignee are aware of no appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. SUMMARY OF THE CLAIMED SUBJECT MATTER

A summary of the claimed subject matter, as claimed in sole independent Claim 10, is mapped out below, with reference to page and line numbers in the specification added in **[bold]** after each element.

A process for carrying out an exothermic chemical equilibrium reaction in a fluidized-bed reactor **[page 2, lines 31-32]** comprising only one fluidized bed and only one gas distributor, **[page 9, lines 1-6]** wherein there is a temperature distribution along the flow direction in the fluidized bed of the fluidized-bed reactor and the temperature difference between the lowest temperature and the highest temperature is at least 10 K **[page 2, lines 32-35]** and wherein the temperature within the fluidized bed decreases from an absolute temperature maximum along the flow direction to the surface of the fluidized bed and to the gas distributor, **[page 3, lines 34-36]** and

wherein the distance between the absolute temperature maximum and the gas distributor is smaller than the distance between the absolute temperature maximum and the surface of the fluidized bed. **[page 3, lines 36-39]**

IV. ARGUMENT

Ground (A)

Claims 10, 13-17 and 19-26 stand rejected under 35 U.S.C. § 103(a) as unpatentable over US 2002/0172640 (Hibi et al) in view of US 2008/0047872 (Iaccino et al) and US 3,482,946 (Shirk). That rejection is untenable and should not be sustained.

As recited in Claim 10, an embodiment of the present invention is a process for carrying out an exothermic chemical equilibrium reaction in a fluidized-bed reactor comprising only one fluidized bed and only one gas distributor, wherein there is a temperature distribution along the flow direction in the fluidized bed of the fluidized-bed reactor and **the temperature difference between the lowest temperature and the highest temperature is at least 10 K** [temperature difference feature] and **wherein the temperature within the fluidized bed decreases from an absolute temperature maximum along the flow direction to the surface of the fluidized bed** [temperature decrease to fluidized bed feature] **and to the gas distributor** [temperature decrease to the gas distributor feature], and

wherein **the distance between the absolute temperature maximum and the gas distributor is smaller than the distance between the absolute temperature maximum and the surface of the fluidized bed** [distance difference feature].

(Emphasis added).

Hibi et al discloses a process for producing chlorine by oxidizing hydrogen chloride with oxygen in the presence of a supported ruthenium oxide catalyst (Abstract), which process can be carried out in a reactor such as a fixed bed reactor, fluidized reactor, tank type reactor, and the like [0067]. Hibi et al discloses further that the fluidized bed system has an

advantage that the temperature distribution width in the reactor can be reduced because heat in the reactor can be sufficiently removed [0068].

The Examiner finds that Hibi et al does not disclose the temperature decrease to fluidized bed feature of the present claims, but relies on Iaccino et al.

Iaccino et al discloses an exothermic reaction process for converting methane to liquid hydrocarbons in at least two reactors in series, such as in multiple catalyst beds with heat removal between beds, and wherein the lead bed(s) may be operated at higher temperatures to maximize kinetic rates and the tail bed(s) may be operated at lower temperatures to maximize thermodynamic conversion [0098].

Shirk is drawn to a reactor for contacting vaporous reactants with fluidized solids. The reaction zone of the reactor is divided into a series of fluidized-solids compartments by perforate trays, cross beams and vertical nesting support members (column 2, lines 40-42). Each compartment has temperature control means so that the mixture of vapors and fluidized-solids moving freely within and between compartments may have independent temperature adjustment within each compartment (Abstract). The holes in the perforated trays have an adequate size to permit the catalyst to continuously flow into and out of a given compartment from above and below, which will effectively reduce by-passing, forward and backward mixing and channeling problems associated with open fluid bed reactors and many tray-containing reactors (column 2, lines 49-64). Shirk discloses that his reactor design provides an excellent means of maintaining the desired operating temperature within about 3 to at most 5 Fahrenheit degrees (or well-below the presently-recited minimum of 10 Kelvin degrees (18 Fahrenheit degrees))--assuring the removal of exothermic heat of reaction of oxidative

dehydrogenation processes and maintaining a near isothermal reactor temperature profile (column 4, lines 48-53).

The Examiner finds that the bottom perforated tray as shown in Fig. 1 of Shirk acts as a "gas distributor" and that Fig. 1 of Shirk can be considered to be one fluidized bed because it uses only one gas stream. The Examiner continues that it would have been obvious to optimize various process conditions, as listed, in order to obtain the desired temperature in the fluidized bed. The Examiner seems to find that the various above-emphasized features of Claim 10 would either be inherently carried out or obvious to optimize by following Iaccino et al. Based on all the above, the Examiner holds that it would have been obvious to carry out the exothermic chlorine-producing reaction of Hibi et al with a higher temperature at the beginning of the reaction, i.e., lead bed, and a lower temperature at the end, i.e., tail bed, as suggested by Iaccino et al, to maximize both kinetic rates and thermodynamic conversion, and to use a single fluidized bed reactor, as suggested by Shirk "because this reactor is compartmented and each component can serve as a 'bed' as suggested in [Iaccino et al] and the temperature in each compartment can be controlled independently to obtain the higher and lower temperatures as desired by [Iaccino et al]."

In reply, without the present disclosure as a guide, one of ordinary skill in the art would not have combined Hibi et al, Iaccino et al and Shirk, but if combined, the result would not be the presently-claimed invention. Indeed, none of the above-emphasized features of Claim 10 would be satisfied by such a combination.

As to Shirk, there is no temperature control unit at the bottom of his fluidized bed, which is labeled as an "auto-regeneration zone." The reactants, according to Shirk, are fed into the reactor in one of the temperature controlled zones through the line which is labeled as

"charge." At the bottom of the reactor, only a gas which does not perform any reaction is fed. This gas, together with a second one which is fed into a temperature controlled zone, are mixed, after which, the reaction starts. This operation allows for an isothermal temperature distribution within the reactor. Therefore, according to Shirk (as well as Iaccino et al), each reactor is operated under isothermal conditions. There is neither disclosure nor suggestion in either Iaccino et al or Shirk to carry out the reaction while satisfying the above-emphasized distance difference feature, together with the above-emphasized temperature difference, temperature decrease to fluidized bed, and temperature decrease to gas distributor features.

Indeed, if one of ordinary skill in the art were to combine Shirk and Iaccino et al with Hibi et al, the result would be a reactor in which there is an absolute temperature maximum at the mixing point of the reactants. Therefore, there would be no temperature increase in the first zone or in the first reactor. Each of the zones would be operated isothermally. In addition, one of ordinary skill in the art would try to operate the reactions isothermally wherein a first reaction zone is operated at a higher temperature and the second zone at a lower temperature. However, neither Shirk nor Iaccino et al provides any suggestion that it could be advantageous to have a temperature distribution along the flow direction in the fluidized bed wherein there is a temperature difference between the lowest temperature and the highest temperature of at least 10 K and wherein the temperature within the fluidized bed decreases from an absolute temperature maximum along the flow direction to the surface of the fluidized bed and wherein the distance between the absolute temperature maximum and the gas distributor is smaller than the distance between the absolute temperature maximum and the surface of fluidized bed.

Note further that according to Shirk, the "auto-regeneration zone" is used to return the catalyst by means of a dip leg to obtain effective internal solids circulation and maintain solids in the fluidized bed in a desired condition (column 2, line 70 to column 3, line 9). There is no reaction performed in the auto-regeneration zone and therefore, there is no temperature increase at first, followed by a temperature decrease, in the fluidized bed.

Nor is there any suggestion from the applied art that the above-emphasized temperature distribution features lead to an improved space-time yield, as described in the specification at page 3, lines 14-17. Nor is there any suggestion that the above-emphasized distance difference feature has the advantage that catalyst systems containing active components which are volatile at elevated temperatures, as ruthenium compounds, can be operated with better long-term stability, as described in the specification at page 3, lines 19-22. In addition, the above-emphasized temperature distribution features have the further advantage that heat exchange capacities and thus capital costs can be reduced, since a smaller quantity of heat has to be transferred to the feed gases and the quantity of heat to be removed from the fluidized bed by means of heat exchangers is smaller, since the colder feed gas can take up a major part of the heat liberated in the exothermic reaction directly in the fluidized bed, as described in the specification at page 4, lines 1-11.

None of the above could have been predicted by the applied prior art.

For all the above reasons, it is respectfully requested that this rejection be REVERSED.

Ground (B)

Claims 10-17 and 19-26 [sic, 10, 13-17 and 19-26 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Hibi et al in view of US 5,573,657 (Degnan et al) and Shirk. That rejection is untenable and should not be sustained.

The deficiencies of Hibi et al and Shirk have been discussed above under Ground (A) and are hereby incorporated by reference. Degnan et al does not remedy these deficiencies.

Degnan et al discloses a hydrogenation process for reducing the unsaturation of lubricants, which uses a catalyst based on ultra-large pore crystalline material (Abstract) and that for an exothermic process such as hydrogenation, it is thermodynamically favored by lower temperatures but for kinetic reasons, moderately elevated temperatures are normally used and for petroleum refining processes, temperatures in the range of 100° to 700°F are typical (column 1, lines 32-36).

The Examiner holds that it would have been obvious to maximize both the kinetic rate and the thermodynamic conversion for the process of Hibi et al by operating the fluidized bed at two different temperatures, i.e., at a higher temperature for kinetic reasons and lower temperature for thermodynamic reasons, as suggested by Degnan et al, and that it would have been obvious to use the apparatus of Shirk.

In reply, there is neither disclosure nor suggestion in Degnan et al that an exothermic chemical reaction can be carried out in a fluidized bed reactor, and satisfying all of the above-emphasized features of Claim 10. At best, in order to achieve different temperatures as required by the present claims, one skilled in the art in view of the applied prior art would employ two separate reactors wherein a first reactor is operated at a first temperature and the second reactor at a second temperature, or the part of the reactor is operated at a first

temperature and the second part of the reactor is operated at a second temperature. Such a process would be different from, and not suggestive of, that presently claimed.

For all the above reasons, it is respectfully requested that this rejection be REVERSED.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, L.L.P.

Harris A. Pitlick
Registration No. 38,779

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 06/04)

CLAIMS APPENDIX

Claim 10. A process for carrying out an exothermic chemical equilibrium reaction in a fluidized-bed reactor comprising only one fluidized bed and only one gas distributor, wherein there is a temperature distribution along the flow direction in the fluidized bed of the fluidized-bed reactor and the temperature difference between the lowest temperature and the highest temperature is at least 10 K and wherein the temperature within the fluidized bed decreases from an absolute temperature maximum along the flow direction to the surface of the fluidized bed and to the gas distributor, and

wherein the distance between the absolute temperature maximum and the gas distributor is smaller than the distance between the absolute temperature maximum and the surface of the fluidized bed.

Claim 13. The process according to claim 10, wherein the temperature of the reaction gases fed to the fluidized-bed reactor is below the lowest temperature occurring in the fluidized bed.

Claim 14. The process according to claim 10, wherein the temperature distribution is produced by heat transfer to at least one heat exchanger within the fluidized bed.

Claim 15. The process according to claim 10, wherein the chemical reaction is the preparation of chlorine from hydrogen chloride and oxygen.

Claim 16. The process according to claim 10, wherein the fluidized bed comprises a catalyst which comprises a metal component on an oxidic support.

Claim 17. The process according to claim 16, wherein the catalyst comprises a ruthenium compound.

Claim 19. The process according to claim 10, wherein the fluidized bed is divided into two temperature zones.

Claim 20. The process according to claim 10, wherein the temperature distribution is produced by heat transfer to at least one heat exchanger within the fluidized bed, and the distance between the gas distributor and the nearest heat exchanger above the gas distributor is at least 25 cm.

Claim 21. The process according to claim 20, wherein the distance is at least 50 cm.

Claim 22. The process according to claim 10, wherein the fluidized-bed reactor is designed as a bubble-forming fluidized bed having a superficial gas velocity of from 0.01 to 1 m/s.

Claim 23. The process according to claim 22, wherein the superficial gas velocity is from 0.5 to 0.50 m/s.

Claim 24. The process according to claim 10, wherein a heat exchanger is located in the lower part of the fluidized bed and a heat exchanger is located in the upper part of the fluidized bed.

Claim 25. The process according to claim 19, wherein a dividing plate is positioned between the two temperature zones.

Claim 26. The process according to claim 25, wherein the dividing plate is configured as a perforated plate having openings in the shape of a truncated cone.